

# Ankur Singh

Dual Degree Student

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## Academic Qualifications

Year	Degree	Institute
Aug 2020 - Sep 2021	M.Tech, Electrical Engineering	Indian Institute of Technology, Kanpur
Aug 2016 - July 2020	B.Tech, Electrical Engineering	Indian Institute of Technology, Kanpur
March 2015	AISSE	Air Force School, Viman Nagar, Pune
March 2013	AISSE	Air Force School, Viman Nagar, Pune

## Research Interests

- Deep Learning, Computer vision, Incremental Learning, Self-Supervised Learning, Medical Imaging

## Scholastic Achievements

- Secured All India Rank 636 in JEE Advanced 2016 (99.682 percentile)
- Secured 99.18 percentile in JEE Mains 2016
- Holder of Prime Minister Scholarship

## Publications

- **Multi-Input Fusion for Practical Pedestrian Intention Prediction** , Ankur Singh, Upendra Suddamalla .  
- *Accepted at ICCV Workshops 2021* [Link]
- **The Curious Case of Convex Networks** , Sarath Sivaprasad, Ankur Singh, Naresh Manwani, Vineet Gandhi.  
- *Accepted at ECML 2021* [Link]
- **CT Image Synthesis Using Weakly Supervised Segmentation and Geometric Inter-Label Relations For COVID Image Analysis**, Dwarikanath Mahapatra, Ankur Singh, Behzad Bozorgtabar. - *Under Review at MedIA* [Link]
- **Pedestrian Intention Prediction with Multi-Input Concatenation**, Ankur Singh, Upendra Suddamalla.  
- *Accepted at CVPR Workshops 2021* [Link]
- **Video Colorization using CNNs and Keyframes Extraction: An application in saving bandwidth**, Ankur Singh, Anurag Chanani, Harish Karnick. - *Accepted at CVIP '19 Oral* [Link].

## Research Experience

- **Semi-Supervised Super Resolution, M.Tech thesis** [Link] (Sep' 20-Ongoing)  
*With Prof. Piyush Rai, Prof. Vipul Arora, IIT Kanpur*
  - Introduced a semi-supervised approach to tackle the problem of Single-Image Super-Resolution using ESRGANs.
  - Proposed a consistency loss to convert unpaired low-resolution images to high-resolution images.
  - Quantitative and qualitative experiments proved the efficacy of the proposed approach over other methods.
- **Pedestrian Intention Estimation** (Sep' 20-Ongoing)  
**Research Intern, Moovita Singapore**
  - Proposed an intention prediction network that utilizes pedestrian bounding boxes, pose, bounding box coordinates.
  - The network implicitly learns pedestrians' motion cues and location information to differentiate between intentions.
  - Experimented with different combinations of input features and proposed multiple efficient models.
- **Convex Neural Networks** (Aug' 20-Nov '20)  
*With Prof. Vineet Gandhi, IIIT Hyderabad*
  - Investigated a constrained formulation of neural networks where the output is a convex function of the input.
  - Showed that these networks have outstanding generalization ability and robustness to label noise
  - Experiments showed that convex MLP networks outperform vanilla MLP on standard image classification datasets
- **Medical Imaging for Covid Image Analysis** (April '20-July '20)  
*With Dr. Dwarikanath Mahapatra, Inception Institute of Artificial Intelligence*
  - Generated synthetic images to train networks for segmenting COVID-19 infected areas from lung CT images.
  - Introduced a weakly supervised segmentation (WSS) step that segments a CT image into different labeled regions.
  - The generated segmentation maps are used to model the geometric relationship between the different pathological regions.

- **Adversarial Incremental Learning** (May '19-Nov '19)  
With **Prof. Vinay Namboodiri, IIT Kanpur**
  - Formulated an approach using **Adversarial Learning** to tackle class-incremental learning in image classification.
  - The proposed model neither used exemplars nor any generative examples to preserve information about the old tasks.
  - Obtained **state of the art results** in class-incremental learning on CIFAR-100, MNIST and SVHN datasets.
- **Video Colorization using CNNs and Keyframes Extraction (CVIP '19 Oral)** (Aug '18-Nov '18)  
With **Prof. Harish Karnick, IIT Kanpur**
  - Developed an end to end framework that **extracts key frames** from a colored video and **trains a Convolutional Neural Network** from scratch on these colored frames.
  - Saved **two thirds** of bandwidth while transmitting a video using the proposed method.
  - The whole process starting from key frames extraction to training a model and then obtaining the colored output video, happened in **near real-time** using the proposed method.
- **ECG arrhythmia classification using 2D CNN** (May '18-July '18)  
**Vios Medical, Bangalore**
  - Used **2-Dimensional CNNs** instead of the traditional LSTM models to detect arrhythmia in ECG signals.
  - Achieved an accuracy of **98.31** in classifying 6 different types of arrhythmia using different classification networks
  - **Github Repository** of the project currently has **148 stars** and **82 forks**

## Other Projects

- **Medical Imaging for Breast Cancer detection** (Apr '20-May '20)
  - Worked on BACH Grand Challenge for Computer Aided Detection of Breast Cancer from medical images.
  - Used Self Supervised Learning to pre-train networks for tackling less medical data.
  - Achieved an accuracy of 89% on the test set.
- **GANs** (Apr' 20)
  - Did a literature survey on different GANs such as Least Squares GANs, Cycle GANs, Super-Resolution GANs
  - Implemented Least Squares GANs, Cycle GANs and Super-Resolution GANs in Pytorch
- **Self-Supervised Learning** (Aug '19-Nov '19)
  - Did literature survey of various self-supervised learning techniques using different pretext tasks.
  - Experimented with different pretext tasks such as predicting image rotations, edge detection in images etc
- **Hierarchical Face localization and Drowsiness detection** (Dec '18)
  - Developed a near-realtime approach for heirarchical face localization and drowsiness detection.
  - Used temporal features of the video for drowsiness detection.
- **Word Boundary detection** (Aug '18 - Nov '18)
  - Used MFCC Vectors and spectrograms to detect word boundaries in speech.
  - Used Convolution Neural Networks on spectrograms for word boundaries.
- **Tweets Classification** (Dec '17)
  - Classified tweets mentioning personal intake of medicine in twitter using LSTM and Bidirectional LSTM.
  - Used self trained word embedding models to pre process the tweets using Word2Vec.
- **Prosthetic Arm** (May '17 - June '17)
  - Engineered an artificial gripper on the concept of prosthetics using 3D printing and communication via Bluetooth.
  - Employed micro-controllers(Arduino ATmega and Nano) to communicate with an auxilliary glove having flex sensors.

## Technical Skills

- **Programming Languages:** Python, C, Matlab
- **Machine Learning Tools:** Pytorch, Keras, Tensorflow, Sklearn, Numpy, OpenCV, Pandas, NLTK, Matplotlib, PIL

## Relevant Coursework

- |                              |                                 |                     |
|------------------------------|---------------------------------|---------------------|
| • Visual Recognition         | • Machine Learning              | • Neural Networks   |
| • Image Processing           | • Fundamentals of Computing     | • Linear Algebra    |
| • Probability and Statistics | • Introduction to Real Analysis | • Complex Variables |